balloon, *S-20*, damaged when it was forced down into trees near Reedville, Ky.

A new menace, nonmeteorological in character, was reported by some of the pilots: while they were sailing over the mountains of Kentucky and Virginia, several of the mountaineers proceeded to shoot them up. As none of the balloons was hit, it was evidently merely an admonition from these native sons for the pilots to keep on their way.

A very complete schedule of broadcasting weather information for the pilots was carried out with a high degree of success. From the log of the *Goodyear IV* we learn that messages and programs were listened to during the first night from stations in New York City, Cincinnati, Memphis, Hot Springs, and Los Angeles. On the 30th mention is made of reports from Chicago, St. Louis, and Pittsburgh. Van Orman in a telegram to the Chief of the Weather Bureau says, "The weather data furnished at Little Rock, also the flying and regular forecasts which were broadcast, helped us win the national race and establish new records. Every flying forecast broadcast was received, also 80 per cent of the regular forecasts. Please accept my thanks and convey them to the members of your Bureau who assisted."

In the table below are given some details of the race. It will be noted that the shortest distance covered by a contestant was 473 miles, with small increases in distance from one record to the next, except for the winner, who exceeded his nearest competitor by more than 200 miles. According to Ralph Upson, noted balloonist and starter of the race, the previous record for balloons of this size was 305 miles; even the smaller *Skylark* exceeded this by more than 100 miles.

Name of pilot and aid	Entrant	Name of balloon	Place and time of landing	Distance
				Miles
W. T. Van Orman (W. W. Morton).	Goodyear Tire & Rubber Co., Akron, Ohio.	Goodyear IV	8 miles SSE. of Petersburg, Va., 1:03 a. m. May 1.	848
Capt. H. C. Gray (Lieut. D. Johnston).	U. S. Army Air Service, Scott Field, Ill.	S-23	7 miles N. of Mount Holly, N. C., 12:08 p. m. May 1.	635
J. A. Boettner (H. W. Maxson).	Akron Chapter N. A. A., Akron, Ohio.	Akron N. A. A.	7 miles NE. of Welch, W. Va., 7:45 p.m. Apr. 30.	627
Lieut. James F. Powell. (Lieut. James F. Early).	U. S. Army Air Service, Phillips Field, Md.	S-21	12 miles due N. of Hickory, N. C., 5 p. m. Apr. 30.	618
Herbert V. Thaden (C. D. Williams).	Detroit Flying Club, Detroit Aviation Society.	Detroit	3 miles W. of Gulnare, Ky., 2:10 p. m. Apr. 30.	574
Lieut. Wm. A. Gray (Lieut. R. Kieburtz).	U. S. Army Air Service, Langley Field, Va.	S-20	Reedville, Carter County, Ky.,— p. m. Apr. 30.	570
Svend A. U. Rasmussen. (Edward J. Hill).	Detroit Adcraft Club, Detroit, Mich.	Detroit Adcraft	3 miles W. of Blaine, Ky., 5 p. m. Apr. 30.	566
Capt. L. F. Stone (Capt. G. R. Oatman).	U. S. Army Air Service, McCook Field, Dayton, Ohio.	S-19	7 miles SE. of Heidelberg, Ky., 2:30 p. m. Apr. 30.	510
Walter A. Ham (Robt. P. Lehr).	Walter A. Ham, Los Angeles, Calif.	Goodyear Southern California.	5 miles E. of Brodhead, Ky., 11 a. m. Apr. 30.	473
W. C. Naylor (K. W. Warren).	The Arkansas Gazette, Little Rock, Ark.	Skylark (pilot balloon).	4 miles N. of Crawford, Tenn., 11:30 a. m. Apr. 30.	410

551.578.1(794) NOTES, ABSTRACTS, AND REVIEWS

EXTRAORDINARY APRIL RAINS IN CALIFORNIA

The unprecedented rains in some parts of California in April, 1926, call for some mention of the attendant meteorological conditions.

On April 1, five days previous to the arrival of the rains, a weak cyclonic system was charted in W. longitude 150°; N. latitude 30°; associated therewith was an anticyclone, centered in W. longitude 160°; N. latitude 50°. The latter, being in the more rapidly flowing eastward drift of the higher latitudes, advanced to the Mackenzie Basin by the evening of the 4th. Meanwhile the more slowly moving oceanic cyclone had increased considerably in intensity and it continued further to increase, reaching its maximum development on the morning of the 7th in W. longitude 135°; N. latitude 45°. Twenty-four hours previously an offshoot from it had passed inland over California giving the general and heavy rains as above noted.[1]

The oceanic cyclone on the morning of the 8th occupied practically the whole of the Pacific north of N. latitude 30 and east of W. longitude 170°; it also had encroached upon the continent as far as W. longitude 120° in Alaska and 110° in northwestern Mexico.

If, in the beginning, the position of the cyclone and anticyclone had been reversed, as is normally the case in that part of the Pacific, very little, if any, precipitation would have occurred in California. It is a basic maxim in the forecasting of precipitation in this country that the conditions are most favorable when the geographic position of the cyclone and the anticyclone is such that the former is to the southwest of the latter.

This position was reached on the 5th and 6th and although the centers of the two formations were spearated by at least 30° of latitude the result was never in doubt and was quickly foreseen by the San Francisco forecaster. The chief meteorological factor concerned in the causation of the rains in question was the relative position in time and space of the two barometric formations above described.

As has been pointed out, that position was the exact opposite of the one normally to be expected, viz, high pressure over the northeast Pacific in approximately, W. longitude 148°; N. latitude 32°, in April and it was this abnormal pressure distribution that led to the rains in California.

The fact that heavy April rains have occurred once within the 50-odd years of observation can not, however, be interpreted to mean that similar heavy rains will occur in the next 50 years. It is within the range of probability that several occurrences of heavy rains in April may be experienced in the next 50 years and on the other hand there may not be a single occurrence.—*A. J. H.*

[1] Cf. Reed, T. R., p. 181 of this REVIEW.

551.578.1 (265.1)

RAIN SQUALLS OF THE ATLANTIC TRADE-WIND REGION

K. Knoch, in Publication No. 335 of the Prussian Meteorological Institute (Berlin), 1926) discusses certain aspects of the temperature and relative humidity observations obtained by the late E. Barkow on board the ship *Deutschland* in the Atlantic trade-wind region during June, July, and August, 1911.

The rain squalls are phenomena apparently not related to the ordinary trade-wind cumulus. They occurred between latitudes 25° and 20° N. with a frequency averaging 1.9 per day, 3 per day between latitudes 20° and 15°, and 2 per day between 15° and 10°. In the 5-degree belt north of the Equator the frequency was 1, in 0° to 5° S. it was 3, dropped to 1.1 between 5° and 10° S., rose to 3 in the belt 10°–15°, and to 4 per day between 15° and 20° S. These figures are based, of course, on

meager data, but, at least for this period, indicated a maximum rain squall frequency for the northeast trade-wind zone between 20° and 15°, and beyond 5° S. a distinct increase in frequency toward the higher latitudes. It is to be noted that the observations in the latter group were made during the Southern Hemisphere winter.

The normal trade-wind curve of temperature, while extraordinarily steady, nevertheless is made up of a multitude of tiny changes; and corresponding to these the trace for relative humidity seesaws constantly through a range of largely 2 to 5 per cent (occasionally reaching 8 to 10), these oscillations being superposed upon the very small diurnal swing.

The curves for temperature and relative humidity in the rain squalls are unmistakably different from these normal trade-wind curves, and they strongly resemble those made over a heated land surface. They seem to show clearly that isolated bodies of cold air exist in the otherwise uniformly turbulent trade-wind stream, the instability which they help to produce being altogether more marked at the surface than the normal instability which produces the trade-wind cumuli.

Two general types of temperature change occur with the rain squalls:

1. A fall lasting 2 to 4 hours, usually irregularly. It is sometimes interrupted by a slight rise, after which the approach to the minimum is more rapid than before. Recovery of normal temperature may be either slow or rapid.

2. A type requiring at the most three-quarters of an hour for the completion of the changes during the passage of the ship through the body of cold air, sometimes scarcely 20 minutes.

There was one very special case (June 29, in latitude about 23° N.) differing from the above types. First occurred a slight cooling incident to a strong northerly squall with light to moderately heavy rain, and then came a sharp rise of temperature to above normal upon the veering of the wind into the ESE. The author suggests that this rise was due to the thrusting northward of warm air from lower latitudes in some manner connected with the passage of the cold air. Adequate discussion of this case was impossible, however; observations on wind direction were taken only at 4-hour intervals.

With regard to occurrence of the rain squalls in the southeast trades, the *Deutschland* registrations show clearly that the cold-air masses reached to 6° S. They have been observed with southeast wind on the South American coast northeast of Pernambuco.

The author regards these cold-air bodies as remnants of larger air masses thrust forward from high latitudes to and in part within the trade-wind boundaries, their breaking up giving opportunity for the rain squalls. He points out that this is, in a sense, nothing new, for it is well known that in winter, polar-air streams now and then reach almost to the Equator. The registrations discussed are, however, of special interest because they are the first automatic records from the Atlantic showing cold-air thrusts into the trade-wind zones.—*B. M. V.*

AN UNDERDEVELOPED TORNADO

By G. SHIPMAN

[Weather Bureau Office, Fort Smith, Ark., May 24, 1926]

An underdeveloped tornado closely followed by a straight blow occurred at Fort Smith, Ark., during the late afternoon of April 23, 1926. It developed at the front of an advancing HIGH on the wind-shift line accompanied by a sharp drop in temperature. The sky was clear until 4:30 p. m. when it changed to partly cloudy, becoming cloudy at 5:30 p. m. A few alto-stratus clouds from the south were observed until 4:30 p. m., changing then to lower clouds with a dense bank to the north. At 5:30 the clouds became denser, with a small turbulent mass of mammato-cumulus moving from the south. The lower clouds moved from south to north, while the higher ones, when observed, moved from west to east along the path of the storm. Lightning, starting at 5:30 p. m., was vivid during the entire storm, the flashes, mostly perpendicular, passing from higher clouds through scud to the earth. The tornado cloud appeared at Fort Smith at 6:15 p. m., earlier to the west, and later to the east. It was observed by several persons, as a dense bank of greenish clouds with a narrow rope-like pendant. The pendant cloud rose and fell, seldom touched the earth, moved slowly, taking about three minutes to pass Fort Smith, dissolved to a mass of scud occasionally and reformed again at intervals of some miles. Light precipitation and light hail accompanied the storm. Moderate southerly winds prevailed during the day increasing after 6:00 p. m., attaining an extreme velocity of 61 miles at 6:26 p. m. and a maximum velocity for five minutes of 49 miles from the northwest at the same time. The wind shifted often during the storm and remained northwest to west afterwards. The pressure curve showed weak tornado features with a short, sharp drop before the storm and a rise of 0.30 inch in three hours following. Two persons in ordinary buildings in the path of the storm described the passage of the cloud over them as violently shaking the buildings without causing serious damage. The damage resulted from a straight blow that followed the storm by about 10 minutes. A five-month infant was killed at Branch, Ark., and about $10,000 damage was done at Fort Smith, with one person slightly injured. The storm's path was very narrow and extended from Salisaw, Okla., to Branch, Ark., about 52 miles. The débris and damage in the path showed straight blow effects as did instrumental records and direct observations. Had this storm occurred at night without observation of the tornado cloud probably no tornado would have been reported. Only persons near the tornado cloud heard any attendant noises.

551.467 (048) (98)

ARCTIC ICE IN 1925

[Reprinted from *Nature*, London, April 17, 1926]

The Danish Meteorological Institute has published its annual report on the state of the ice in the Arctic seas.

As usual, the data are most numerous from the Barents Sea, Spitsbergen, the west coasts of Greenland and Alaska, but in 1925 a good deal of information was available from the east coast of Greenland. From the Beaufort Sea and the coast of Siberia practically no data came to hand. The most notable feature of the year was the unusually small amount of ice observed in practically all the Arctic seas that were visited. During the summer, the Barents Sea was free from ice and the Kara Sea was remarkably open. Spitsbergen waters were very clear, and during August there was open water round practically the whole of the group. Franz Josef Land, as usual, was more or less inaccessible but there was open water on the north of Novaya Zemlya in August. On the east coast of Greenland the ice belt was narrow, and there appears to have been less drift from the north than usual. Bering Strait was open in June, but the north coast of Alaska not until late in July. Commander C. I. H. Sperrschneider, the editor of the report, comments on the facts that for several years, particularly in 1925, little old ice was found in the east Greenland or east Spitsbergen currents, and that most of the ice was of one winter's formation.